UTILITY POLE CROSS-ARM AND ASSOCIATED POLE-TOP HARDWARE

Field of the Invention

This invention relates to cross-arms and associated pole-top hardware for use in relation to utility poles for the support of aerial conductors in electricity distribution and transmission systems.

The invention is particularly directed towards such hardware for use in low to medium voltage systems, that is to say, systems operating within the range of from consumer voltages (nominally 240/414 volts in Australia) to say 33 kilovolts.

Background Art

Traditionally, utility poles and cross-arms used in such systems have been of timber. In more recent times tubular steel poles have started to replace wooden poles, because of the availability and relative costs of the two types of pole. The same cannot be said of cross-arms, which are still primarily of timber. This arises because the relatively small line insulators used in systems of low to medium voltage produce an air gap between the aerial conductor and the cross-arm that is within the distances that may be bridged by birds alighting or perching upon the cross-arm. This is not of major concern in respect of wooden cross-arms. Even when wet, the wooden cross-arm has enough resistance to limit fault currents through the bird to the grounded metal pole to a tolerable level, certainly well below that which would trigger line fuses or other system protection.

Summary of the invention

An aim of the present invention is to provide an alternative to timber cross-arms in low to medium voltage distribution and transmission systems.

According to a first aspect, the invention relates to a cross-arm for a utility pole for use in low to medium voltage electricity distribution and transmission, the cross-arm being metallic and coated with an insulatory coating.

In a particular form, the cross-arm is formed from a profiled metal sheet and in a particular embodiment as a hollow steel section. In another form, the cross-arm is formed with a channel or Z section. Further, preferably the coating is a polymeric material such as nylon or a thermoplastic resin. In another form, the coating is made from an epoxy based product. In one form the coating is applied by an electrolytic powder coating process, using a powder of the polymeric material.

The inventors have found that a metal cross-arm produced with an insulatory coating is able to be used in place of traditional timber cross-arms. The incorporation of the coating provides enough resistance (say greater than 10kV/mm) to limit fault currents which may occur by a bird or the like bridging the cross-arm and the aerial connector. The advantage of using a metallic cross-arm is that it is less expensive, more durable, and easier to install as it is significantly lighter than traditional timber cross-arms.

A second invention is directed to a fastening system for fastening a cross-arm to a utility pole. In this aspect, the fastening system comprises clamping means that is securable to one of either the pole or the cross-arm,

the clamping means being operative to extend about the other of the pole or cross-arm to which it is secured and applying a clamping force to that member so as to fasten the cross-arm and pole together.

This fastening system has significant advantages as it uses a clamping action rather than a direct mechanical fastener thereby obviating the need for a metallic fastener to contact both the cross-arm and the pole.

In a particular form, the clamping means is in the form of a saddle which incorporates end portions securable to either the pole or the cross-arm and a mid portion which is operative to extend around either the pole or the cross-arm to which it is secured so as to apply a clamping force to that member. In one form, the end portions are secured to either the pole or the cross-arm by mechanical fastening and preferably in securing the clamping means to that member, the clamping means is caused to resiliently deform so as to clamp the members together.

In a further form, the fastening system includes a further fastener which is operative to interconnect the saddle and the pole. This fastener may be a mechanical fastener such as a self tapping screw or nut and bolt configuration.

In a particular embodiment the clamping means is metallic and coated with an insulatory coating. Preferably the clamping means is coated with a polymeric material.

In a particular form, the cross-arm is in accordance with the earlier aspect of the invention and is metallic and coated with the insulatory coating.

In this latter arrangement, an insulatory medium, for example a portion of a pliable insulatory sheet or strip may be sandwiched between the pole and cross-arm.

In another embodiment, an extension arm is provided which is mountable to the cross-arm so as to project upwardly from that arm. The extension arm is provided to carry the middle phase in a three phase electricity distribution system so as to increase the separation of the phase wires. With the increased separation, the wires are less susceptible to come into contact along their span between the poles. With this arrangement, greater span length can be achieved which is particularly desirable in rural applications.

In a particular form, the extension arm is metallic and coated with an insulatory coating. Further, in one form, the extension arm is secured to the cross-arm by at least one mechanical fastener.

In a further embodiment, a seat is secured to the utility pole and the cross-arm is operative to be supported on that seat. In this arrangement, the seat can be used instead of, or in conjunction with, the clamping means described in the above form. In one particular form, the seat is also metallic and coated with an insulatory coating. In a particular form the seat is profiled in exactly the same way as the extension arm so as to provide a multipurpose section. This has the advantage of greater inventory control.

In yet a further form, the invention relates to a method of securing a cross-arm to a utility pole, the method comprising the steps of:

providing clamping means arranged to clamp the cross-arm to the utility pole, locating the clamping means over one of the cross-arm or the utility pole, securing the clamping means to the other of the cross-arm or the utility pole whereby, on securing the clamping means, the

clamping means clamps the one member to the other to which it is secured.

Brief Description of the Drawings.

By way of example, embodiments of the invention is described hereinafter with reference to the accompanying drawings:

Figure 1 is an exploded perspective view of an assembly of a top portion of a pole and associated pole-top hardware, including a cross-arm, in accordance with an embodiment of the invention;

Figure 2 is a front elevation of the assembly of figure 1 drawn to a smaller scale;

Figure 3 is a plan view of the assembly of figure 1 drawn to a smaller scale; and

Figure 4 is an exploded perspective view of an alternative to the assembly of figure 1.

Detailed Description of the Preferred Embodiment

The illustrated assembly comprises a tubular steel utility pole 4, a hollow rectangular section steel cross-arm 5, a saddle 6, an insulatory tape wrapper 7, a pole cap 8, bolts 9 able to extend through the side lugs of the saddle 6 and the cross-arm 5 to accept nuts 10 whereby the cross-arm 5 may be clamped to the pole 4, and self tapping screws 12 which are able to extend through the saddle 6 and into the pole 4.

The cross-arm 5, saddle 6 and cap 8 are made of sheet steel, preferably zinc galvanised or similarly coated with a corrosion resistant alloy, for example an aluminium-zinc alloy, and, in accordance with the invention, overcoated with a weather resistant, electrically insulatory coating.

The insulatory coating is a polymeric material, and is designed to have dielectric strength of 15kV/mm. Suitable coatings include the following:

i) thermoplastic coating powder sold by the IPT Group of companies under the trade name of PLASCOAT PPA 571 EF. The coating is applied without requiring a primer and at a thickness of between 150 to 250μm. Pre-treatment includes solvent degrease and surface preparation by phosphate or whip blast.

ii) thermoplastic coating powder sold by Elf Atochem under the trade name RISLAN. The coating is applied at a thickness of 200-250μm. Surface preparation includes chloride solvent or alkaline wash then rinse. The surface is prepared by a whip blast. A primer is used and a suitable primer is a two pack primer sold under the trade name RILPRIM.

iii) epoxy based powder coating sold by Axo Nobel under the trade name INTERPON 100. The epoxy coating is applied at a thickness of approximately 60μm. The coating is pre treated by a solvent degrease and the surface prepared for use by zinc phosphate. A finish coat sold by Axo Nobel under the trade name INTERPON D 2000 is applied over the epoxy based coating.

The saddle 6 is made of relatively thick steel sheet compared to that of the pole 4 and is shaped and sized so that when the nuts 10 are tightened, the pole cross-section under the saddle is elastically strained to adopt a D shape, as indicated at 11. This helps to prevent the nuts from loosening in use and also prevents the cross-arm from rotating about the vertical axis of the pole or about a horizontal axis intersecting that vertical axis and passing through the cross-arm.

Depending on the load requirements of the structure, a fastener may be provided to pierce the saddle 6 and extend into the pole 4. In the illustrated form, self tapping screws 12 are used which are installed after insulation of the saddle. Other fasteners may be used. For example, a nut and bolt arrangement could be employed, where the bolt extends through opposite portions of the saddle, and through the pole with the nut being secured onto a protruding end of the bolt.

The tape 7 may be passed around the pole, as shown, or may be wrapped about the cross-arm. A primary requirement is that part of the tape is sandwiched between the pole and cross-arm to insulate one from the other.

In an alternative configuration the saddle 6 may be arranged vertically instead of horizontally as shown. It would then be positioned on the same side of the pole as the cross-arm, and would of course be re-shaped so as to embrace the cross-arm instead of the pole. In that instance, bolts corresponding to bolts 9 would extend through the pole rather than through the cross-arm. In either circumstance it will be apparent that there would be no electrical connection between the pole and the cross-arm.

In the embodiment of figure 1, an extension arm 13 is disclosed which is mountable to the cross-arm 5. The extension arm 13 is made from a hollow rectangular steel section or formed sheet steel and incorporates an upper end 14 which is operative to support the middle phase wire (not shown) and a lower end 15 which incorporates a nib 16 and coupling plate 21 which is operative to be mounted to a mid section of the cross-arm 5. The nib 16 is designed to be in lapping relationship with an outside surface of the cross-arm 5 so as to improve the stability of the

connection of the extension arm 14 with the cross-arm. Whilst not shown, typically the extension arm 13 is bolted to the cross-arm 5 through apertures 17 and 18.

By incorporating the extension arm 13, in a three phase wire electricity distribution system, the two outer wires are connected to the cross-arm whilst the middle wire is supported above the other wires on the extension arm 13.

A further arrangement is disclosed in figure 4. Again the arrangement of figure 4 incorporates the cross-arm 5 and the extension arm 13. However instead of using the saddle 6, a seat 19 is provided on which the cross-arm 5 is supported. In the illustrated form, the seat 19 is formed from the same section as the cross-arm 13 thereby providing a multipurpose section. Using this same section, the seat 19 is orientated so that the nib 16 extends upwardly and locates in behind the cross-arm 5. This allows for a tighter engagement of the extension arm 13 and the seat 19 with the cross-arm 5 as the cross-arm is effectively captured between the respective nibs 16. In addition, arranging the elements in this way enables the nibs to be made quite deep without the risk of one nib fouling the other nib which may occur if they are on the same side.

Typically the seat 19 is secured directly on to the utility pole by mechanical fasteners. Further the cross-arm is arranged to be bolted to the seat 19 through bolt 20 which in the illustrated form is also designed to pass through the bottom plate of the extension arm 13.

Those skilled in the art will appreciate that the invention described is susceptible to variations and modifications other than those specifically described.

All such variations and modifications are to be considered within the scope of the present invention.